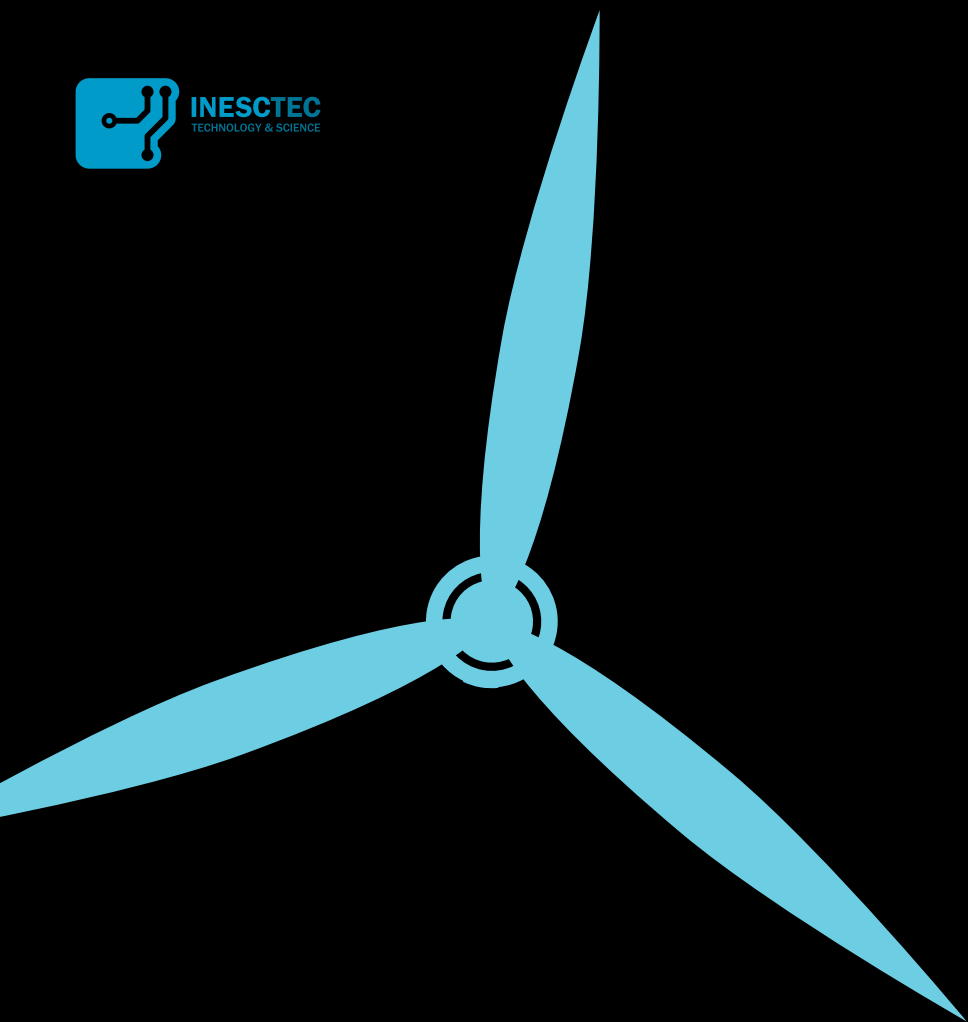


WISE

WIND INTEGRATION IN SMART ENVIRONMENTS



INESCTEC
TECHNOLOGY & SCIENCE



WISE

WIND INTEGRATION IN SMART ENVIRONMENTS

The micro wind turbine inverter developed by INESC TEC is a high value device with integrated grid support functions. The inverter combines a fast and efficient power vs. speed tracking with an advanced Droop control based on grid voltage and real-time frequency measurements. These characteristics prepare the device for the next step in the expansion of micro producers. Additional features such as fast response to voltage and frequency changes allow the distribution network to easily recover when failures occur.

MAIN FEATURES

- Full-scale controllable power flow with low harmonic content
- Integrated 3kW dump load control
- Real-time grid voltage and frequency monitoring
- Continuous overload and short circuit protection
- Computer diagnosis and monitoring software
- Remote control and monitoring
- Online reconfiguration by micro grid controller
- Power derating according to grid condition
- Grid support during disturbances

SPECIFICATIONS

- Maximum power: $\pm 3680W$ // Max. Generator current: 20A
- Generator voltage (line-to-line): 210...260V // Generator frequency: 10...100Hz
- Grid voltage: $230V \pm 20\%$ // Grid frequency: 48...52Hz
- Connectivity: RS232 and USB (firmware upload only)
- Switching frequency: $\geq 20kHz$ // P.F. (full load) > 0.95 // THD (full load) $< 5\%$
- Droop control range: 200...260V, 48...52Hz, -3680...+3680W

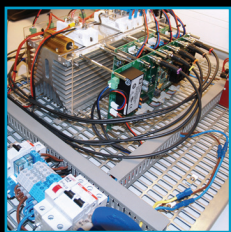


INESC TEC
TECHNOLOGY & SCIENCE
ASSOCIATE LABORATORY
PORTUGAL

CAMPUS DA FEUP
R DR. ROBERTO FRIAS
4200 - 465 PORTO
PORTUGAL

T +351 222 094 000
F +351 222 094 050
info@inesctec.pt
www.inesctec.pt





SISE

SOLAR INTEGRATION IN SMART ENVIRONMENTS



INESCTEC
TECHNOLOGY & SCIENCE



SISE

SOLAR INTEGRATION IN SMART ENVIRONMENTS

The solar power inverter developed by INESC TEC is a high value device with integrated grid support functions. The inverter includes a fast and efficient MPP search, combined with advanced Droop control based on real-time grid voltage and frequency measurements. These characteristics prepare the device for the next step in the expansion of micro producers. Additional features such as fast response to voltage and frequency changes allow the distribution network to easily recover when failures occur.

MAIN FEATURES

- Full-scale controllable power flow with low harmonic content
- Wide PV array voltage range
- Real-time grid voltage and frequency monitoring
- Continuous overload and short circuit protection
- Computer diagnosis and monitoring software
- Remote control and monitoring
- Online reconfiguration by micro grid controller
- Power derating according to grid condition
- Grid support during disturbances

SPECIFICATIONS

- Maximum power: $\pm 3680\text{W}$ // Max. PV array current: 10A
- PV array voltage range: 150...450V
- Grid voltage: $230\text{V} \pm 20\%$ // Grid frequency: 48...52Hz
- Connectivity: RS232 and USB (firmware upload only)
- Switching frequency: $\geq 20\text{kHz}$ // P.F. (full load) > 0.95 // THD (full load) $< 5\%$
- Droop control range: 200...260V, 48...52Hz, -3680...+3680W



INESC TEC
TECHNOLOGY & SCIENCE
ASSOCIATE LABORATORY
PORTUGAL

CAMPUS DA FEUP
R DR. ROBERTO FRIAS
4200 - 465 PORTO
PORTUGAL

T +351 222 094 000
F +351 222 094 050
info@inesctec.pt
www.inesctec.pt



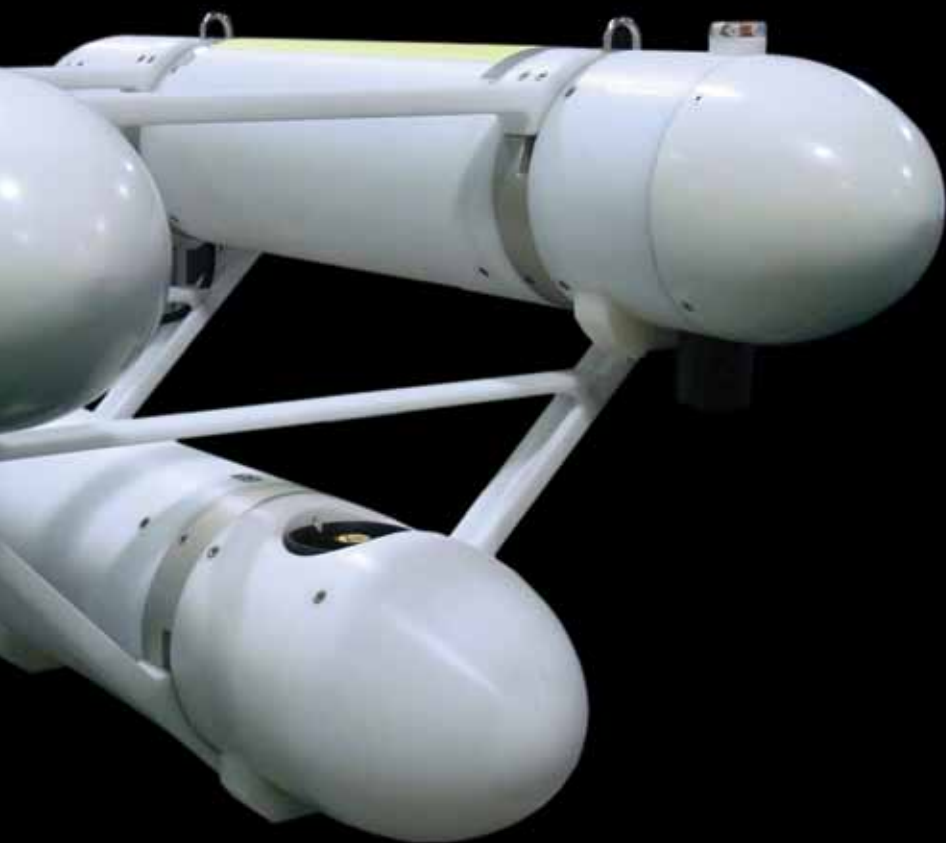


TriMARES

AUTONOMOUS UNDERWATER VEHICLE



INESCTEC
TECHNOLOGY & SCIENCE



TriMARES

AUTONOMOUS UNDERWATER VEHICLE

TriMARES is an underwater vehicle designed for autonomous inspection, bathymetry, mapping and data collection. TriMARES' modular structure is based on the underwater vehicle MARES (OceanSys) and allows different sensor package configurations. Its increased capacity to transport sensors allows it to carry an on-board high resolution video camera, as well as different types of sonar equipment. It can move smoothly in the water, increasing the quality and georeferencing of the collected data. TriMARES was developed in 6 months by INESC TEC and commissioned by a consortium of Brazilian hydroelectric power companies (CEB Lajeado, EDP). The first unit was exported to Brazil in 2011.

MAIN FEATURES

- Modular construction with reconfigurable sections
- Spare ports to accommodate additional payload sensors
- Robust and safe, with fully shrouded moving parts
- Operates in confined spaces - able to ascend/descend on the vertical
- Hovering in the water column - station keeping and close inspection
- 5 degrees of freedom (surge, sway, heave, yaw, pitch)
- Autonomous operation with simple mission definition
- Rechargeable Li-Ion batteries
- Low maintenance
- Optional fibre-optic umbilical for real-time video/data transmission (ROV mode)

SPECIFICATIONS

- Length: 1.3 m // Total width: 80 cm // Overall height: 50 cm // Weight: 75 kg
- Maximum depth: 100 m
- Horizontal speed: 0-2 m/s, variable // Vertical speed: 0-0.3 m/s, variable
- Autonomy / Range: 10 hrs / 40 km
- Typical sensors: video camera, high sensitivity still camera, multibeam sonar, sidescan sonar, CTD, turbidity, fluorescence



INESC TEC
TECHNOLOGY & SCIENCE
ASSOCIATE LABORATORY
PORTUGAL

CAMPUS DA FEUP
R DR. ROBERTO FRIAS 378
4200 - 465 PORTO
PORTUGAL

T +351 222 094 000
F +351 222 094 050
www@inescporto.pt
www.inescporto.pt



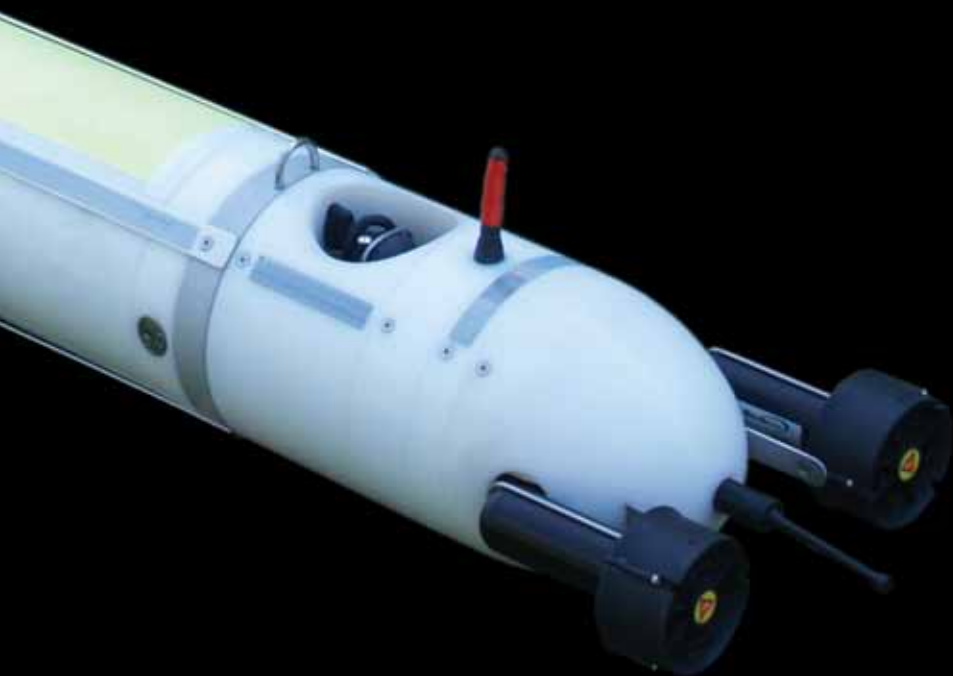


MARES

AUTONOMOUS UNDERWATER VEHICLE



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TECHNOLOGY & SCIENCE



MARES

AUTONOMOUS UNDERWATER VEHICLE

Developed by OceanSys (INESC TEC and FEUP), MARES - Modular Autonomous Robot for Environment Sampling is an autonomous vehicle used in underwater operations. This robot can be easily configured and its modular structure allows it to carry a large variety of sensor packages. MARES can be used for different applications such as environment monitoring, underwater inspection and mapping, and surveillance. An acoustic positioning system makes it possible to georeference collected data. This device has been used regularly since 2007 in environmental monitoring operations.

MAIN FEATURES

- Modular construction with reconfigurable sections
- Spare ports to accommodate additional payload sensors
- Robust and safe, with fully shrouded moving parts
- Operates in confined spaces - able to ascend/descend on the vertical
- Hovering in the water column - station keeping and close inspection
- 4 degrees of freedom (surge, heave, yaw, pitch)
- Autonomous operation with simple mission definition
- Rechargeable Li-Ion batteries
- Low maintenance
- Compact and lightweight - easy transportation and deployment

SPECIFICATIONS

- Length: 1.6 m
- Diameter: 20 cm
- Weight: 32 kg
- Maximum depth: 100 m
- Horizontal speed: 0-2 m/s, variable
- Vertical speed: 0-0.5 m/s, variable
- Autonomy/range: 10 hrs / 40 km
- Typical sensors: CTD, sonar, turbidity, fluorescence, video camera



INESC TEC
TECHNOLOGY & SCIENCE
ASSOCIATE LABORATORY
PORTUGAL

CAMPUS DA FEUP
R DR. ROBERTO FRIAS 378
4200 - 465 PORTO
PORTUGAL

T +351 222 094 000
F +351 222 094 050
www@inescporto.pt
www.inescporto.pt





ROAZ II

AUTONOMOUS SURFACE VEHICLE



INESCTEC
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ROAZ II

AUTONOMOUS SURFACE VEHICLE

ROAZ II is an autonomous surface vehicle designed for aquatic environment monitoring, bathymetry, data collection and oceanography, security and search and rescue missions. With on-board sensor processing and high precision navigation it is capable of operating autonomously in the ocean environment. The robot has a wide range of sensors and advanced on-board controls allowing its use in efficient precision environmental modelling (oceanographic, 3D sea floor modelling), automated intrusion detection, target tracking, identification, area patrol, communications relay in multi-vehicle scenarios and surface support to underwater assets.

On-board ROV in coordinated missions makes it a suitable surface platform for underwater inspection and data collection tasks.

This vehicle has already taken part in various operational missions.

MAIN FEATURES

Autonomous operation

GPS with RTK and INS for precise positioning

RADAR for obstacle detection

Infra-red and visible light cameras

On-board image processing

Wireless communication (data/video)

CTD

Multi-beam sonar and side-scan sonar

LiFePO4 Batteries

On-board inspection ROV (remotely operated Vehicle)

SPECIFICATIONS

Length: 4.25 m // Width: 2 m // Weight: 250 kg

Maximum speed: 10 knots

Autonomy: 11 hours

Electric propulsion: 10 HP

Load capacity: 500 kg



INESCTEC
TECHNOLOGY & SCIENCE
ASSOCIATE LABORATORY
PORTUGAL

CAMPUS DA FEUP
R DR. ROBERTO FRIAS 378
4200 - 465 PORTO
PORTUGAL

T +351 222 094 000
F +351 222 094 050
www@inescporto.pt
www.inescporto.pt



QUADRO
DE REFERÊNCIA
ESTRATÉGICO
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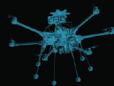
Fundo Europeu
de Desenvolvimento Regional



Fundação para a Ciência e a Tecnologia
Membro da Associação FCT



STRONG
MAR



STRENGTHENING MARITIME
TECHNOLOGY
RESEARCH CENTER



STRONGMAR

STRENGTHENING MARITIME TECHNOLOGY RESEARCH CENTER

AIM INESC TEC is strongly committed to become a center of excellence in maritime technology and, in particular, deep sea technology. The STRONGMAR project aims at creating solid and productive links in the global field of marine science and technology between INESC TEC and established leading research European institutions, capable of enhancing the scientific and technological capacity of INESC TEC and linked institutions (as well as the capacity of partnering institutions involved in the twinning action), helping raising its staff's research profile and its recognition as a European maritime research center of excellence.

OBJECTIVES The main objectives are: provide services and open access to the European academic and industrial communities; become a recognized maritime research asset; build a well-designed and coherent plan for knowledge transfer and exchange of best practices; and enhance the scientific and technological capacity of INESC TEC and linked institutions. These objectives will be fulfilled through a set of measures: summer schools, winter schools, short-term scientific meetings, long-term staff visits, networking meetings, workshops, conferences, technology transfer workshops with stakeholders, and other dissemination activities.

PARTNERS INESC TEC (PORTUGAL) / CINTAL (PORTUGAL) / HERIOT-WATT UNIVERSITY (UNITED KINGDOM) / NATO SCIENCE & TECHNOLOGY ORGANIZATION (BELGIUM) / UNIVERSITAT DE GIRONA (SPAIN) / UNIVERSITY OF ABERDEEN (UNITED KINGDOM)

START JANUARY 2016 **END** DECEMBER 2018 **BUDGET** ~1 M€



INESC TEC
TECHNOLOGY & SCIENCE
ASSOCIATE LABORATORY
PORTUGAL

CRAS
CENTRE FOR ROBOTICS
AND AUTONOMOUS SYSTEMS

CAMPUS DO ISEP
R DR. ANTÓNIO BERNARDINO
DE ALMEIDA, 431
4200-072 PORTO
PORTUGAL

T +351 228 340 554
F +351 222 094 050

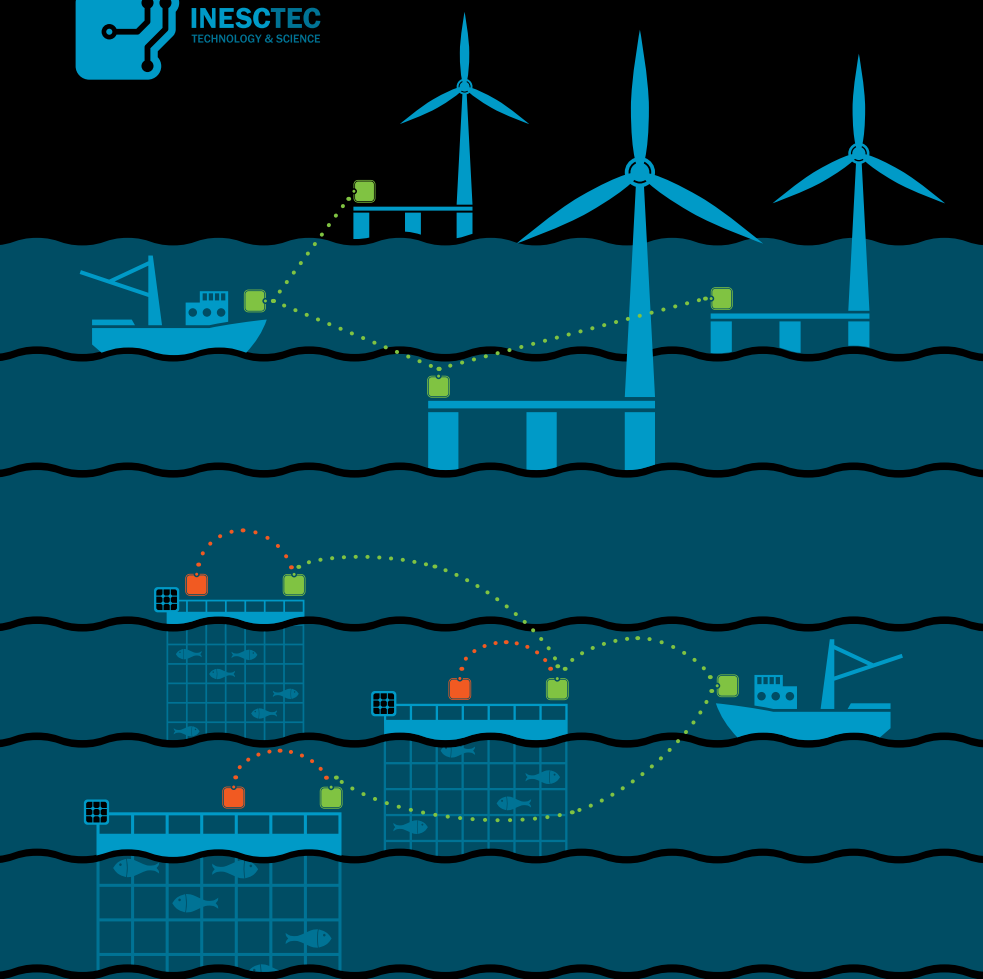
strongmar@inesctec.pt
www.strongmar.eu





JANUS - OS

MULTI-TECHNOLOGY
MESH ACCESS POINT
FOR OFFSHORE FACILITIES



JANUS - OS

MULTI-TECHNOLOGY MESH ACCESS POINT FOR OFFSHORE FACILITIES

Network equipment capable of automatically interconnecting with other boxes to form a single large area mesh network. At the same time, it offers Wi-Fi connectivity to normal terminals. The terminals connected to a JANUS box may communicate with any other terminals, even if they are kilometres apart, as long as they are connected to this broadband network. Each JANUS box provides a set of interfaces to support the integration of different devices and technologies (e.g., GPS, sensors, BT, ZigBee, etc.) and it is capable of providing QoS.

FUNCTIONALITIES

Broadband network connecting off-shore infrastructures and mobile terminals (e.g., user terminals on boats)

Self configured network

Video, VoIP and data exchange among different equipments

Prioritised traffic and QoS – namely events/alarms

Support for data storage

Remote management

JANUS GPS location – estimated position of network clients

MAIN FEATURES

Support for multi-hop and mobile mesh network mode (Wi-Fi)

Scales to large mesh networks (up to 7000 JANUS boxes)

Multiple link layer technologies: Wi-Fi, WiMAX, ZigBee, etc.

Nodes/Clients connect to a normal Wi-Fi connection

Unnecessary network planning: dynamic auto-configuration

TECHNICAL SPECIFICATIONS

Dimensions: 26cm length, 23cm width, 8.8 cm height

Power: DC jack or passive POE, 7-20 V, 5-6 W

Supports renewable energy sources (e.g., solar panels)

Internal Batteries: 12 V, 7.2 Ah

Autonomy: ~10 hours

WRAP-BOX is rated NEMA-67 / IP67



INESCTEC
TECHNOLOGY & SCIENCE
ASSOCIATE LABORATORY
PORTUGAL

CAMPUS DA FEUP
R DR. ROBERTO FRIAS 378
4200 - 465 PORTO
PORTUGAL

T +351 222 094 000
F +351 222 094 050
www@inescporto.pt
www.inescporto.pt



BLUECOM+

AN INNOVATIVE COMMUNICATIONS SOLUTION FOR INTERNET ACCESS AT REMOTE OCEAN AREAS

MOTIVATION

There is no communications solution enabling broadband, cost-effective Internet access at remote ocean areas in alternative to satellite communications.

GOAL

The goal is to develop an innovative communications solution that will enable broadband, affordable Internet access at remote ocean areas for regular devices using standard wireless access technologies, such as Wi-Fi and 4G. The project includes the specification, implementation and laboratory testing of the communication solution, to ultimately create a prototype that will enable broadband Internet access in remote ocean areas, beyond 100km from shore, in alternative to satellite communications.

TARGET GROUPS

THE TARGET GROUPS INCLUDE: MARITIME TRANSPORTATION; FISHERIES, AQUACULTURE AND FISHING INDUSTRY; SCIENTISTS AND RESEARCHERS; COASTAL AND MARINE WATER MANAGEMENT SYSTEM; MARINE BIOTECHNOLOGY, MARINE MINERAL AND ENERGY RESOURCES.

FUNDING

THIS PROJECT IS FUNDED BY NORWAY, ICELAND AND LIECHTENSTEIN THROUGH EEA GRANTS



INESCTEC
TECHNOLOGY & SCIENCE
| ASSOCIATE LABORATORY
PORTUGAL

INESCTEC
R DR. ROBERTO FRIAS
4200-465 PORTO
PORTUGAL



T +351 222 094 000
F +351 222 094 050
info@inesctec.pt
www.inesctec.pt





AQUAMONITOR

SENSORS FOR WATER QUALITY
MONITORING IN INTENSIVE
AQUACULTURE



INESCTEC
TECHNOLOGY & SCIENCE

CO₂
O₂
pH

AQUAMONITOR

SENSORS FOR WATER QUALITY MONITORING IN INTENSIVE AQUACULTURE

INESC TEC is leading a consortium – which includes CIMAR – Centro Interdisciplinar de Investigação Marinha e Ambiental –, the CIQ FCUP – Centro de Investigação em Química at the University of Porto, and the University of Pécs in Hungary – created to develop new sensors for real time water quality monitoring in hyper intensive aquaculture systems. In systems of stackable shallow raceway tanks with water recirculation there are more fish present in less water. Therefore, it is necessary to accurately and constantly monitor parameters, including dissolved CO₂ and O₂, pH, nitrates and phosphates.

Currently used tools do not respond to the industry's needs. However, these types of tools are critical to reducing the investment risk and to increasing fish production and welfare. In order to make these tools capable of responding to these needs, they should be equipped with more effective optical sensors. New optical sensors are being developed by the consortium for this purpose.

In this project, optical fibre interferometric platforms are being combined with sensitive polymeric membranes to enable the detection of different analyte concentrations with the same instruments. The target analyte in the project is dissolved CO₂ but the technology will evolve towards the detection of multiple parameters to determine water quality.

Developed in 2 years (2011-2012)

MAIN FEATURES

- Electromagnetic immunity
- Based on standard telecom optoelectronics
- Miniaturisation and versatility
- Multipoint multiparameter detection
- High sensitivity
- Real time remote operation
- Adaptable for different applications

FCT-PTDC/AAC-AMB/112424/2009; FCOMP-01-0124-FEDER-013911



INESC TEC
TECHNOLOGY & SCIENCE
ASSOCIATE LABORATORY
PORTUGAL

CAMPUS DA FEUP
R DR. ROBERTO FRIAS 378
4200 - 465 PORTO
PORTUGAL

T +351 222 094 000
F +351 222 094 050
www@inescporto.pt
www.inescporto.pt





PROTEU

ADVANCED OPTICAL SENSOR
FOR MONITORING ESTUARINE
AND COASTAL ENVIRONMENTS



INESCTEC
TECHNOLOGY & SCIENCE



PROTEU

ADVANCED OPTICAL SENSOR FOR MONITORING ESTUARINE AND COASTAL ENVIRONMENTS

INESC Porto has developed technology to monitor temperature and salinity in coastal environments using an innovative fully integrated monitoring infrastructure based on optical fibre. As part of the research project PROTEU, an 11 km optical fibre cable, with Bragg sensors placed every 500 meters, was installed that runs from the mouth of the Ria de Aveiro and follows the Espinheiro channel bed to the Vouga river. This made it possible to measure the water temperature at each sensor location in real-time. The results of this project are currently being used in several studies concerning the Ria de Aveiro and the surrounding area and are crucial for continuous environmental assessment and management.

This technology is now being explored further and will be able to measure salinity and other chemical and biological parameters (dissolved CO₂, cyanobacteria) making it an advanced analytical tool for the monitoring and study of marine conditions in estuarine environments.

Developed in 2004

MAIN FEATURES

Electromagnetic immunity

Based on standard telecom optoelectronics

Multipoint detection

High sensitivity

Real-time remote operation

Quasi distributed sensing

Adaptable for the detection of other environmental parameters

SPECIFICATIONS

11 km Optical fibre cable (TONGERE from CABELTE S.A.) with three SMF 28® optical fibres with 19 Fibre Bragg grating temperature sensors distributed every 500 m. Cable anchored to the river bed with concrete structures placed every 500 m in the vicinity of the sensors.

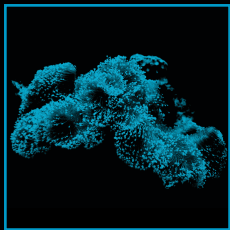


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TECHNOLOGY & SCIENCE
ASSOCIATE LABORATORY
PORTUGAL

CAMPUS DA FEUP
R DR. ROBERTO FRIAS
4200-465 PORTO
PORTUGAL

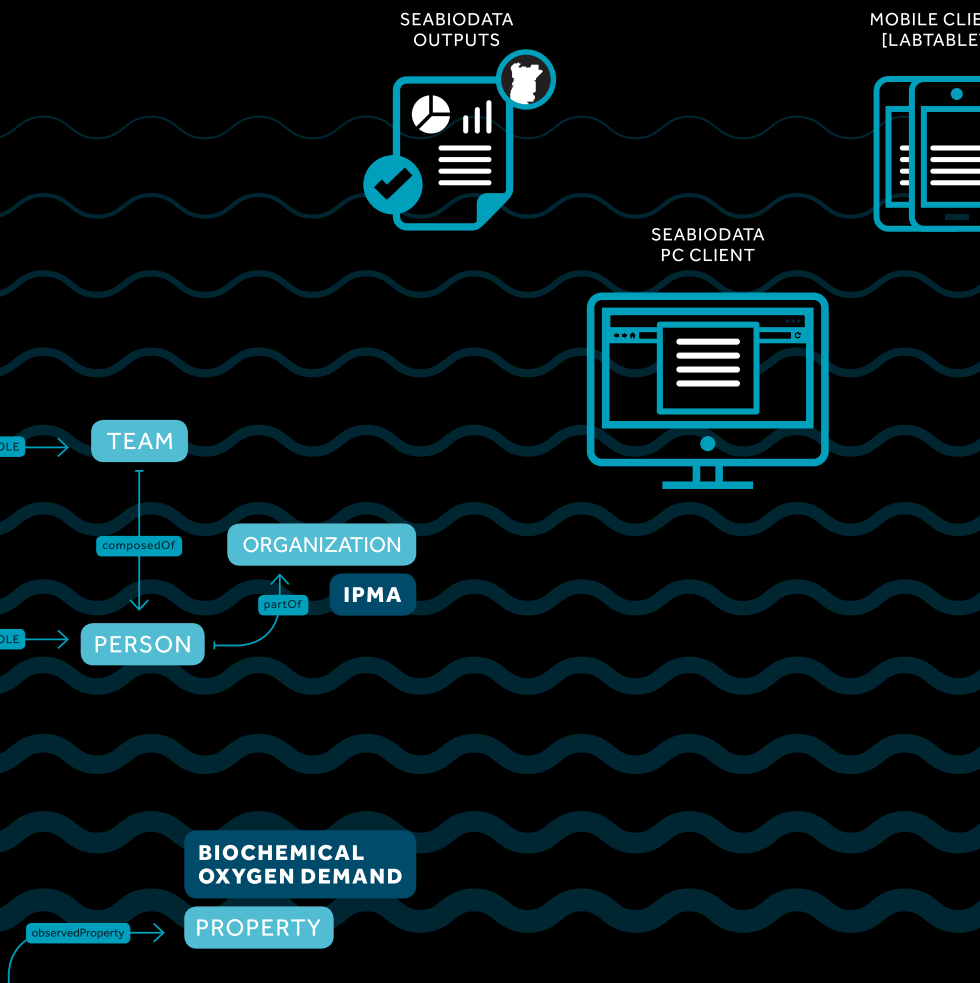
T +351 222 094 000
F +351 222 094 050
info@inesctec.pt
www.inesctec.pt





SeaBioData

PORTUGUESE SEAMOUNTS BIODIVERSITY DATA MANAGEMENT



SeaBioData

PORTUGUESE SEAMOUNTS BIODIVERSITY DATA MANAGEMENT

AIM

Development of an adequate technological framework for the effective and efficient monitoring of particular ecosystems such as seamounts, providing adequate and timely information to stakeholders. Thus contributing for the establishment of the Good Environmental Status (GES), the monitoring of resources and the promotion and preservation of Portuguese marine environment and their biodiversity.

INESC TEC MAIN CONTRIBUTION

Conception and development of an adequate technological framework to ensure that the biological material and associated information, collected in the project BIOMETORE (EEAGrants, PT02_Aviso2_0001) about the biodiversity of seamounts and their ecosystems, namely in the Madeira-Tore and Great Meteor, is compiled and fully accessible. The system will ensure the integration, organization and long-term preservation of relevant data for marine information systems, enabling prompt and uniform data access to researchers at a local and national level.

Seabiodata (EEAGrants, PT02_Aviso5_0002) will provide new means to store and access original datasets and a set of interoperable services to disseminate observation data, thus providing baseline information for sustainable management of the Portuguese marine environment, as well as to the development of the marine strategies for the continuous assessment and maintenance of the good environmental status (GES).

START DATE JULY 2015

END DATE APRIL 2017

BUDGET 229K€

PARTNERS

IPMA – INSTITUTO PORTUGUÊS DO MAR E DA ATMOSFERA (PORTUGAL)

IMR – INSTITUTE OF MARINE RESEARCH (NORWAY), AS CONSULTANT

FUNDING

SEABIODATA WAS CO-FINANCED BY EEA GRANTS, EUROPEAN ECONOMIC AREA FINANCIAL MECHANISM, JOINTLY FINANCED BY ICELAND, LIECHTENSTEIN AND NORWAY



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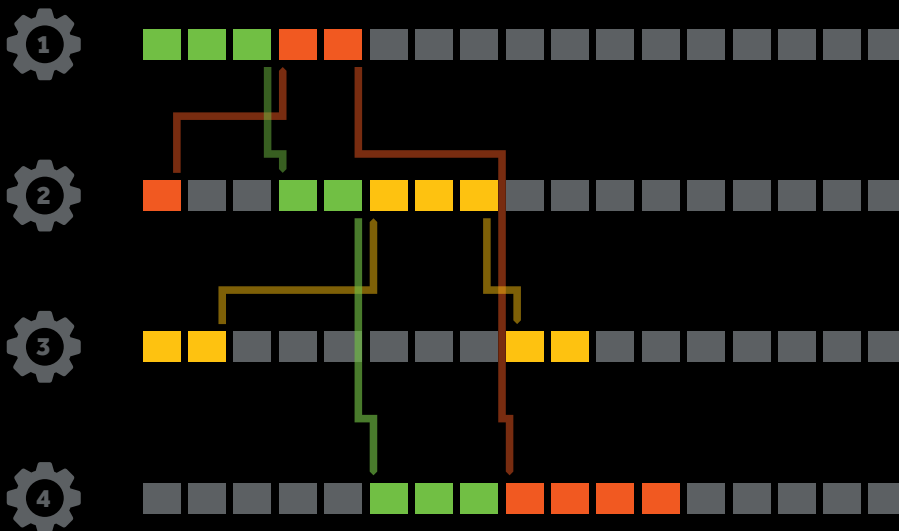
INESC TEC
R DR. ROBERTO FRIAS
4200-465 PORTO
PORTUGAL



T +351 222 094 000
F +351 222 094 050
info@inesctec.pt
www.inesctec.pt



ADVANCED PLANNING AND SCHEDULING SYSTEMS



ADVANCED PLANNING AND SCHEDULING SYSTEMS

In a globalised world manufacturing organisations seek to improve their competitive position by increasing operational performance. Production planning and operations scheduling are crucial to this end, representing today one of the most challenging tasks to managers. Furthermore, planners are struggling with the increasing complexity of production processes and with the lack of support planning tools that consider constraints and specific features of real world problems.

INESC TEC has a large experience in designing and developing innovative tools to optimise production planning and operations scheduling, thus contributing to reduce the gap between the practical needs of real production planning and commercially available solutions which are in general very strict and hard to use.

INESC TEC has designed and developed an optimisation engine that can be integrated with standard ERP or scheduling systems to enhance the global quality of schedules. This engine uses state-of-the-art, multi-criteria optimisation procedures and leads to considerable gains in productivity. Criteria such as reduction of delays or increase in resource utilisation can be considered at the same time, by using these procedures.

The benefits of this approach are even more evident in scenarios with a large number of production orders, different types of resources, complex product structures, or bottlenecks. Moreover, in a context where multiple criteria are taken into account, planners are involved in the process and they interact with the system to choose one of the multiple generated scheduling solutions (which correspond to different trade-offs between objectives).

Each solution is shown in a Gantt chart, allowing the planner to assess the quality of the schedule under analysis, in a multiple perspective way.

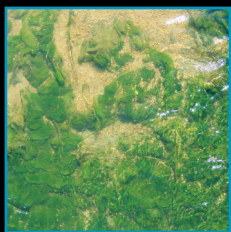


INESC TEC
TECHNOLOGY & SCIENCE
ASSOCIATE LABORATORY
PORTUGAL

CAMPUS DA FEUP
R DR. ROBERTO FRIAS 378
4200 - 465 PORTO
PORTUGAL

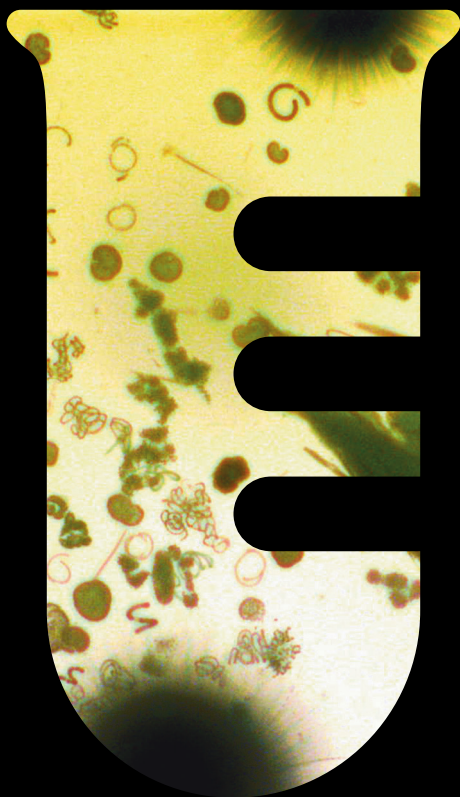
T +351 222 094 000
F +351 222 094 050
www@inescporto.pt
www.inescporto.pt





MODAL

MODELS FOR PREDICTING
ALGAE BLOOMS



MODAL

MODELS FOR PREDICTING ALGAE BLOOMS

The occurrence of abnormal amounts of certain species of phytoplankton may be associated with eutrophication, which can lead to serious risks in terms of public health, particularly when these phenomena occur in places where drinking water is collected. Forecasting these phenomena in advance is essential for taking preventive actions and thus avoid undesirable consequences.

INESC TEC has applied, compared and adapted several modelling techniques to the problem of predicting harmful algae blooms in the hydrographical bay of river Douro, namely in the reservoir of the Crestuma-Lever dam.

This is a prediction problem with a strong social and economic impact on the metropolitan area of Porto because most of the drinking water in this region comes from this dam.

RESULTS

- Several algorithms developed for forecasting algae blooms
- Software for monitoring and forecasting algae blooms



CAMPUS DA FEUP
RUA DR. ROBERTO FRIAS
4200-465 PORTO
PORTUGAL



T +351 222 094 000
F +351 222 094 050
info@inesctec.pt
www.inesctec.pt



FCT Fundação para a Ciência e a Tecnologia
MINISTÉRIO DA CIÊNCIA, TECNOLOGIA E ENSINO SUPERIOR